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IS 9277 (1979): Code of Safety for Monochlorobenzene. UDC 614.878 : 547.539.211.2

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(Reaffirmed 2007)

IS : 9277 - 1979

Indian Standard

CODE OF SAFETY FOR MONOCHLOROBENZENE

UDC 614·878 : 547·539·211·2

भारतीय मानक ब्यूरो
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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

September 1980

AMENDMENT NO. 1 DECEMBER 2006
TO
IS 9277 : 1979 CODE OF SAFETY FOR MONOCHLOROBENZENE

(*Page* 4, *clause* 3) — Insert the following new clause at the beginning and renumber the subsequent clause

'**3.1 General Information**

a)	Molecular formula	C_6H_5Cl
b)	Molecular weight	112.56
c)	CAS No	108-90-7
d)	UN No	1134'

[*Page* 4, *clause* **3.1**(m)] — Substitute '637.8°C' *for* '673.8°C'

(*Page* 5, *clause* **4.1.1**) — Insert the following at the end

'Monochlorobenzene is confirmed animal carcinogen with unknown relevance to humans.'

(*Page* 5, *clause* **4.1.5**) — Substitute the following for the existing text

'Threshold Limit Value (TLV) 10 ppm

(*Page* 6, *clause* **5.2.4**) — Insert the following new clause after **5.2.4**

'**5.3 Incompatibles** — Monochlorobenzene is reactive with the following substances

Alkali metals (sodium or potassium and its alloys) or alkaline earth metals (calcium or magnesium) — violent, possibly explosive reaction

Strong oxidizing agents (dinitrogen tetroxide, nitric acid, perchloric acid or peroxides) — may react violently with risk of fire and explosion

Strong reducing agents [*phosphorus, tin (II) chloride, metal hydrides*] — may react violently or explosively

Dimethyl sulphoxide decomposes violently on contact with chlorobenzene

Silver perchlorate and acetic acid form a shock-sensitive salt which may explode when struck

Phosphorus trichloride and sodium may explode

(CHD 8)

Reprography Unit, BIS, New Delhi, India

Indian Standard

CODE OF SAFETY FOR MONOCHLOROBENZENE

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(*Continued on page* 2)

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(*Continued on page* 9)

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CODE OF SAFETY FOR MONOCHLOROBENZENE

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 12 November 1979, after the draft finalized by the Chemical Hazards Sectional Committee had been approved by the Chemical Division Council.

0.2 Monochlorobenzene (MCB) also known as phenyl chloride or cholorobenzol is used in solvent mixtures and for producing crackle or matt effects in lacquers; as a solvent for ethyl cellulose and resins, oils and fats, and for commercial synthesis of phenol, aniline, picric acid and other intermediates used in the production of dyestuffs, drugs and perfumes, and as a basic material in DDT manufacture

0.3 Handling and storage of monochlorobenzene is not at present covered by any specific act. It is, however, preferable to observe precautions indicated for storage and handling of dangerous petroleum as given in the 'Petroleum and Carbide of Calcium Manual'.

0.4 In the preparation of this code, considerable assistance has been drawn from the following publications:

i) National Safety Council, USA — Accidents Prevention Manual.
ii) U.S. Public Health Bulletin No. 271.
iii) Patty. A. Frank — Industrial Hygiene and Toxicology, Second Edition. Inter-Science Publishers.
iv) Kirk-Othmer, Encyclopedia of Chemical Technology, Second Edition. Inter-Science Publishers.
v) Sax N. Irving — Dangerous properties of Industrial materials, 1975 Edn. Van Nostrand Reinhold Co, New York (USA).

1. SCOPE

1.1 This standard describes the properties of monochlorobenzene, the nature of hazards associated with it, suggested preventive measures for controlling the hazards and essential information on storage, handling, packing, employee education, personal protective equipment and first aid.

1.2 This code does not deal with detailed design of buildings, process equipment and storage containers.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 4155-1966* and IS : 4167-1966† shall apply.

3. PROPERTIES OF MONOCHLOROBENZENE

3.1 The important properties of monochlorobenzene are:

a) Appearance : Clear, colourless liquid
b) Smell : Penetrating characteristic odour of almonds
c) Molecular weight : 112·56
d) Boiling point : 131·7°C
e) Freezing point : –45°C
f) Flash point : 29·4°C
g) Fire point : 36°C
h) Refractive index : 1·521 6 (25°C)
j) Density : 1·113 at 15°/15°C
k) Vapour density : 3·88
m) Self ignition temperature : 673·8°C
n) Lower explosive limit : 1·8 percent at 100°C
p) Upper explosive limit : 9·6 percent at 150°C
q) Solubility : Insoluble in water, miscible with most organic solvents
r) Vapour pressure :

Temp	*mm Hg*
0°C	3
20°C	9
40°C	26
60°C	65
80°C	144
100°C	292
120°C	543

---

*Glossary of terms relating to chemical and radiation hazards and hazardous chemicals

†Glossary of terms relating to air pollution.

4. HAZARDS ASSOCIATED WITH MONOCHLOROBENZENE

4.1 Health Hazards

4.1.1 *General* — Monochlorobenzene is a fairly strong narcotic and possesses only slight irritant qualities. The entry of a chlorine atom into an aromatic compound reduces its toxicity. In agreement with this general observation monochlorobenzene is less toxic than benzene itself. It is a central nervous system depressant when taken orally and will cause symptoms typical of its anaesthetic effect. At the same time degeneration of liver and kidneys may be observed. Toxicological studies and experience indicate that monochlorobenzene will not cause the type of blood changes seen with benzene exposure.

4.1.2 *Acute Toxicity* — Acute exposure has been rather rare in industry. Slight skin irritation may occur from application of monochlorobenzene on the skin. Repeated contact for a week may result in moderate erythema and slight superficial necrosis. Somnolence, loss of consciousness, twitching of the extremities, cyanosis, deep rapid respirations and a small irregular pulse are the chief symptoms occurring in acute exposures. The urine may be burgundy red, and the red blood cells show degenerative and regenerative changes.

4.1.3 *Chronic Toxicity* — It is possible that prolonged exposure to monochlorobenzene may cause kidney and liver damage, as the studies reported on rabbits, rats and guinea pigs indicate this.

4.1.4 *Contact with Eyes* — Moderate pain, lachrymation and conjunctival hyperemia were observed as a result of eye application of monochlorobenzene.

4.1.5 *Threshold Limit Value* (*TLV*) — Recommended TLV* for monochlorobenzene is 350 mgm/m^3 of air (75 ppm) for repeated exposure for 8 hours work day and 40 hours work week. This value may be used as a guideline in controlling environmental contamination and personnel exposure.

4.1.5.1 The recommended Ventilation Design Concentration (VDC) is 50 ppm.

4.2 Fire Hazard — It is highly flammable and dangerous when exposed to heat or flame. When heated to decomposition it emits highly toxic fumes of chlorine compounds. It can react vigorously with oxidizing materials. While fighting fire, breathing apparatus shall be worn. Use foam, carbon dioxide or suitable dry powder.

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*As accepted by the American Conference of Governmental Industrial Hygienists, USA.

4.3 Explosion Hazard — The hazard is moderate when exposed to heat or flame. Vapours form explosive mixture with air.

5. STORAGE AND HANDLING

5.1 Storage — Monochlorobenzene is stored in galvanized or mild steel containers. Storage vessels are to be located at safe areas, by adopting the precautions given in the Petroleum Rules, 1937, issued by the Government of India. Since the vapour forms explosive mixture with air open flames should not be allowed where monochlorobenzene is stored or used.

5.2 Handling

5.2.1 Areas where monochlorobenzene is handled shall be posted with 'NO SMOKING' and other appropriate warning signs, as required by the operations.

5.2.2 Leaks and spills shall be tackled only by trained personnel. Monochlorobenzene shall not be permitted to enter drains or sewers if there is a danger of vapours becoming ignited.

5.2.3 Empty containers which have contained monochlorobenzene, except when they are opened for the purpose of cleaning them and rendering them free of monochlorobenzene vapour, shall be kept securely closed unless they have been thoroughly cleaned.

5.2.4 A vapour space of not less than 5 percent of its capacity shall be left in each container containing monochlorobenzene.

6. LABELLING

6.1 All containers of monochlorobenzene shall bear an identifying label as depicted in IS : 1260 (Part I)-1973*. The lower half of the label shall have the following text printed on it:

MONOCHLOROBENZENE

NO SMOKING
DANGER — HIGHLY FLAMMABLE
KEEP AWAY FROM HEAT, SPARKS AND OPEN FLAME

---

*Pictorial markings for handling and labelling of goods : Part I Dangerous goods (*first revision*).

KEEP CONTAINER CLOSED
USE WITH ADEQUATE VENTILATION
AVOID REPEATED CONTACT WITH SKIN
AVOID PROLONGED BREATHING OF VAPOUR

7. TANK AND EQUIPMENT CLEANING AND REPAIRS

7.1 Tank and equipment cleaning shall be done under the supervision of trained personnel who are familiar with the hazards and preventive measures required for the safe performance of the work.

7.2 Tanks, equipment and other accessories shall be fully drained, washed and cleaned before undertaking any repair work. All sources of ignition are to be eliminated from the vicinity of the tank to be repaired. Pipe lines to the tank shall be disconnected and the connecting lines shall be blanked off. Tank is then to be steamed to remove any residual monochlorobenzene vapour. After the tank is cooled tests for oxygen deficiency and monochlorobenzene vapour shall be conducted and only then the repair work shall commence.

7.3 A work permit should be obtained before starting repairs.

8. PREVENTIVE MEASURES

8.1 Process Building — In building a factory which is to be suitable from both technical and hygienic points of view it is important that doors, windows, walls, partitions and platforms shall be well-ventilated and of fire-resistant construction. Construction shall take into account the need to prevent outflow in the case of spillage and confine it in the section where it occurs. A high standard of plant cleanliness has to be maintained.

8.2 Housekeeping — There shall be a constant campaign against careless and dirty habits. The floor of workroom shall be impervious to water. A metallic receptacle with tight fitting cover shall be used for depositing waste like rags, paper or other materials soiled with monochlorobenzene The waste shall be destroyed by burning at least once a week.

8.3 Ventilation — Good ventilation is essential in rooms or areas where monochlorobenzene is handled to prevent acccumulation of explosive mixtures. If mechanical ventilation is used, flameproof fans and electrical equipment should be provided in conformity with the relevant Indian Standards.

8.4 Personal Hygiene — A high standard of personal hygiene is essential while working with monochlorobenzene. Working garments, gloves, aprons, boots, goggles shall be cleaned daily or as soon as soiled. Stress should be on urgent necessity for changing at once and taking bath when the dresses are soiled. A shower bath with soap at the end of shift shall be compulsorily taken every day. Do not chew, eat or drink in work place or with soiled hands. Before meal wash hands, feet and face well. Keep food articles and drinks away from workplace.

8.5 Personal Protective Appliances — Personal protective appliances are not adequate substitutes for good, safe working conditions, proper ventilation and intelligent conduct on the part of employees working with monochlorobenzene. However, in many instances it is the only practical means of protecting the worker, particularly in emergency situations. Depending on the area and type of handling, the appropriate protective wear for protection of eyes, head, foot, body and hand and respiratory tract shall be used.

8.6 Employee Education and Training — Safety in handling monochlorobenzene depends on a great extent upon the effectiveness of employee education, proper job instructions, intelligent supervision and practical safe procedures. Since the risk due to fire is greater, emphasis should be on safe handling, and use of appropriate type of equipments. The possibility of fire, starting due to static electricity should be specifically brought out. Employees should be constantly informed of the hazards that may result from improper handling

9. FIRST AID

9.1 Skin Contact — Remove contaminated clothing. Wash exposed areas thoroughly with water

9.2 Contact with Eyes — Flush eyes thoroughly with water for at least 15 minutes. Do not attempt to put any lotion or ointment. Contact physician.

9.3 Inhalation — In case of exposure to high concentrations resulting in narcotic symptoms, remove the patient to uncontaminated area at once. If breathing is difficult give artificial respiration and call a physician.

(*Continued from page* 2)

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INDIAN STANDARDS ON CHEMICAL AND ALLIED HAZARDS

IS:	
1260 (Part I)-1973	Pictorial markings for handling and labelling of goods : Part I Dangerous goods
1446-1959	Classification of dangerous goods
4155-1966	Glossary of terms relating to chemical and radiation hazards
4209-1966	Code of safety for chemical laboratories
4262-1967	Code of safety for sulphuric acid
4263-1967	Code of safety for chlorine
4264-1967	Code of safety for caustic soda
4312-1967	Code of safety for lead and its compounds
4544-1968	Code of safety for ammonia
4560-1968	Code of safety for nitric acid
4607-1968	Classification of hazardous chemicals and chemical products
4644-1968	Code of safety for benzene toluene and xylene
4906-1968	Code of safety for radiochemical laboratory
5184-1969	Code of safety for hydrofluoric acid
5208-1969	Code of safety for acetic acid
5302-1969	Code of safety for acetic anhydride
5311-1970	Code of safety for carbon tetrachloride
5685-1970	Code of safety for carbon disulphite (carbon bisulphide)
5931-1970	Code of safety for handling cryogenic liquids
6156-1971	Code of safety for chlorosulphonic acid
6164-1971	Code of safety for hydrochloric acid
6269-1971	Code of safety for ethylene oxide
6270-1971	Code of safety for phenol
6818-1973	Code of safety for phosphoric acid
6819-1973	Code of safety for calcium carbide
6953-1973	Code of safety for bromine
6954-1973	Code of safety for caustic potash
7415-1974	Code of safety for aniline
7420-1974	Code of safety for phthalic anhydride
7444-1974	Code of safety for methanol
7445-1974	Code of safety for acetone
7812-1975	Code of safety for mercury
8185-1976	Code of safety for phosgene
8388-1977	Code of safety for nitrobenzene
9052-1978	Code of safety for aluminium chloride, anhydrous
9053-1978	Code of safety for *m*-dinitrobenzene

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	*siemens*	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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